The Efficiency-Resilience Nexus

FACTSHEET

What is Resilience?

Resilience (sometimes referred to as "resiliency") has been defined broadly as "the ability to resist being affected by an event or the ability to return to an acceptable level of performance in an acceptable period of time after being affected by an event.

The importance of resilience will only increase into the future, with increased frequency of extreme weather events—including heat waves, wildfire, and coastal storms—projected to occur as a result of climate change.

In the event of a disaster or extreme event, the benefits of energy efficient buildings can extend far beyond cost savings. Buildings designed to be energy efficient and/or store or produce energy onsite offer a greater level of protection to the people and operations they house.

How Do Energy Efficiency and Onsite Energy Contribute to Resilience?

Energy efficiency measures contribute to resilience in a number of ways (see Call Out Box):

▸ Increased Passive Survivability

Energy efficiency increases the passive survivability of buildings—the ability of buildings to maintain habitable conditions in the event of a heating/cooling system loss. Efficient buildings, especially those that incorporate passive design characteristics such as green roofs or passive solar heating, stay warmer in the winter and cooler in the summer. This increased level of passive protection can allow individuals to shelter in place during an adverse event, potentially reducing morbidity and mortality. This is particularly important for residential buildings. It is also relevant for public buildings that might serve as community relief centers during adverse events.

▸ Long-Lasting Backup Power from Distributed Generation

During a power outage, backup power (e.g., batteries, on-site solar, or combined heat and power [CHP]) allows for continuity of operations and building habitability. The Better Buildings Initiative has published an extensive guide to using distributed generation to build resilience, and previously ran an accelerator program to build critical infrastructure resilience through CHP.

Energy efficiency measures are a powerful complement to onsite energy generation and storage, as they can significantly reduce the necessary size and cost of installing backup power systems, and can increase the usefulness of existing backup power.[1] This is of particular relevance for commercial and industrial customers, for whom the economic impacts of a loss of power tend to be significantly greater than for residential customers.[2]

EE and Onsite Generation: Value in Good Times and Bad

	Energy Efficiency	Efficiency with Onsite Generation/Storage
During normal grid/fuel supply operations	Protection from price spikes Lower costs for total energy required Greater comfort, higher indoor air quality Reduced likelihoood of outages due to demand spikes	Deeper cost savings – reduced demand charges, sale of excess power to grid Support Renewable Energy targets/goals Reduced likelihood of outages due to demand spikes
During a grid outage event	Passive survivability	Continuity of energy services

Lower Risk of Grid Overload

Decreased electricity demand may decrease the likelihood of grid failures during extreme events (e.g., heat waves) that drive peak demand beyond system capacity.[3] This can happen when demand rises across large areas connected by high-capacity transmission lines, but also if demand spikes in a small community using the same distribution infrastructure.[4] In 2006, a record-breaking heat wave in California spiked energy demand to levels beyond system capacity, leaving hundreds of thousands of customers without power during one of the hottest periods on record.[5]

The Cohousing and Ecovillage community in Belfast Maine was constructed with energy-efficient principles of passive survivability in mind, including triple-paned glass, optimized passive heating from sunlight, and heavily insulated, airtight envelopes. During a 2013 ice storm that led to a five-day loss of power and heat, residents with efficient housing were able to stay in their homes, while homes in neighboring communities saw below-zero indoor temperatures within 24 hours.

Lower Exposure to Event-Driven Price Spikes

Efficient buildings reduce the energy consumer impact of event-driven (e.g., heat wave, cold snap) price spikes on power and heating fuel. In 2014, after the Polar Vortex event caused a spike in natural gas prices, the average customer of one gas utility in Illinois saw monthly bills increase by 57 percent.[6] Simple efficiency measures can have major benefits in insulating firms and individuals from such major price swings.

Taking Action

There is increasing recognition by authorities and community leaders across the U.S. of the importance of building community and energy system resilience to a range of hazards. New York City established an Office of Resiliency and Recovery in 2014, for example, and the Department of Homeland Security established official principles of resilience in 2017.[7]

Tools for Building Resilience through Efficiency

Visit the Better Buildings Solution Center Resilience page at https://betterbuildingssolutioncenter.energy.gov/challenge/special-initiatives/resiliency to access a range of resources to help building owners and managers move forward towards increased resilience.

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[1] https://rmi.org/a-resilience-strategy-based-on-energy-efficiency-delivers-five-core-values/

[2] https://emp.lbl.gov/sites/all/files/lbnl-6941e.pdf

[3] https://aceee.org/research-report/u1508

[4] https://www.nerc.com/comm/OC/SIRTF%20Related%20Files%20DL/SIRTF_Final_May_9_2012-Board_Accepted.pdf

[5] https://www.ocregister.com/2006/07/25/heat-wave-keeps-california-in-its-grip/

[6] https://www.chicagotribune.com/business/ct-polar-vortex-utility-bills-0326-biz-20140326-story.html

[7] https://www1.nyc.gov/site/orr/about/directors-message.page; https://www.dhs.gov/topic/resilience